Canvasses reinforced with metal members

Field of the invention.

The present invention relates to a fabric and to a strip for the reinforcement of canvasses having a plastic coating.
The invention also relates to the use of a fabric and a strip for the reinforcement of canvasses having a plastic coating.

Background of the invention.

Canvasses with a plastic coating are for example used to cover the loads on vehicles or containers, they are also used as tent material.

Such canvasses must meet several requirements.
They must be sufficient strong to avoid tearing due to movement of the load and simultaneously they must be sufficient flexible so that the canvasses can be easily and quickly slid to one side to open them.
A further requirement is that they must give a good protection against vandalism and robbery. Therefore a high resistance against the action of a knife or against the action of a pair of scissors is required.
Since the weight of the canvass limits the amount of load that may be transported by the vehicle or container, the weight of the canvass must be as low as possible.

WO 98/55682 describes a fabric for the reinforcement of canvasses.
This reinforcement consists of strips comprising a thermoplastic matrix and several parallel metal members.
This gives a good flexibility and a rather good resistance against the action of a knife or a cutter. The resistance against the action of a pair of scissors achieved by this embodiment is not always sufficient.

Summary of the invention.

It is an object of the invention to provide a fabric for the reinforcement of canvasses having an improved resistance against the action of a knife or a cutter and against the action of a pair of scissors or a pair of shears.
It is a second object to provide a fabric with a good corrosion resistance.
It is a further object to provide a fabric with a low weight.

According to one aspect of the invention, there is provided a fabric for the reinforcement of canvasses, having a plastic coating.
The fabric comprises a warp and a weft. At least one of the warp or the weft is formed by a strip comprising at least one elongated metal member and a matrix of a thermoplastic material. The thermoplastic material is adherable to the plastic coating of the canvas. A primer layer is applied on the metal member before the thermoplastic material is applied on said coated metal member to realise a good adhesion between the thermoplastic material and the metal member.
The strips have a cross-sectional thickness ranging from 0.5 mm to 3 mm and a cross-sectional width ranging from 3 mm to 25 mm, preferably the thickness is between 0.5 mm and 2 mm and the width is between 3 mm and 15 mm.

The strips forming the warp and the strips forming the weft form meshes with a maximum dimension ranging from 5 cm to 30 cm. The dimension of these meshes can be adapted to the kind of goods that has to be transported. In most cases a maximum dimension of about 7 cm to 15 cm is preferred.

The strips forming the weft can be welded to the strips forming the warp or they can be fixed to each other by means of an adhesive.

According to a second aspect of the invention, there is provided a strip for reinforcement of canvasses having a plastic coating.
The strip comprises at least one elongated metal member and a matrix of a thermoplastic material. The thermoplastic material is adherable to the plastic coating of the canvas. A primer layer is applied on the metal member. This primer layer is required to obtain a good adhesion of the thermoplastic material to the metal member. Such a primer layer is applied on the surface of the metal member before the application of the thermoplastic material.
When no primer layer is applied, the wire could be pulled out the strip without difficulties.

Further, without the application of such a primer layer, the thermoplastic material, such as PVC (polyvinylchloride) flows away during the welding of the strip on the canvass. In this case the metal member is not longer surrounded by the matrix material after the welding. This would result in a fabric which is susceptible of corrosion.
Preferably, the primer layer maintains its adhesion characteristics even if the material is subjected to a heat treatment, for example during the welding of the strips on the canvass.
Therefore, the primer layer preferably withstand a heat treatment during some minutes, for example 5 minutes at 150 °C without losing its characteristics.

The application of a primer layer on the metal further allows it to reduce the thickness of layer of the thermoplastic material. This is of great importance since the amount of thermoplastic material used, has a direct influence on the weight of the reinforced canvass. As described before, it is desirable that the weight of the canvass is as low as possible.

The metal member must give the strip the required strength but must also enable the strip to remain sufficient flexible, preferably in all directions. The flexibility of the strip is strongly influenced by the type of metal member used to reinforce the strip.

The metal member is preferably a flat wire. Flat wire is flexible in the direction perpendicular to the flat side of the wire.
Since the flexibility is determined by the thickness of the wire, the wire is preferably less than 0.40 mm, more preferably less than 0.35 mm, for instance less than 0.30 mm.
Since the resistance against the action of a pair of scissors is increased when the tensile strength is high, a tensile strength of at least 1500 N/mm^2 is preferred, more preferably the tensile strength is greater than 1700 N/mm^2.
To obtain the desired tensile strength a carbon content greater than 0.40 % is preferred.

By preference, the wire is rounded off so that the cross section has no sharp corners, which could result in a damage of the canvass during welding.

Another metal member that can be used is a wire with a rounded I-profile. An I-profiled wire is a wire with a cross section resembling an I-shape. The thickness of the left end and the thickness of the right end are greater than the center thickness of the wire.
This wire has the same flexibility as a flat wire with a thickness equal to the center thickness of the I-profiled wire. The resistance against the action of a pair of scissors of this I-profiled wire is improved in comparison with this flat wire. This resistance equals the resistance of a flat wire with a thickness equal to the thickness of the broader left and right end of the I-profiled wire while the weight of such an I-profiled wire is reduced compared with this flat wire.

In another embodiment the metal member comprises at least two metal members. These metal members are preferably located parallel in the plane of the strip. The metal members could be round steel wires, square wires, rectangular wires or another type of wires. Each metal member is hereby in contact with at least one other metal member, so that they form together a kind of a flat wire.
The plurality of the elongated metal members gives the strip a good flexibility. The resistance against the action of a knife or against the action of a pair of scissors is remained because of the arrangement of the metal members forming a flat wire.

To improve the corrosion resistance of the fabric, the metal member or the metal members can be coated with a metallic coating layer such as zinc or a zinc alloy comprising 2 to 10 % Al and 0.1 to 0.4 % of a rare earth element such as La and/or Ce.

A thermoplastic material such as PVC (polyvinylchloride) is applied on the metal member. The application can be done by any conventional

means. Preferred application methods are extrusion, fluidised bed coating or plastisol coating.

The adhesion of the primer to the wire surface is improved when the surface of the wire is clean. Therefore, it can be desirable to degrease the wire surface before applying the primer layer.

The application of the primer layer may be done by any conventional means.

A first group of primers that can be used are thermosetting materials. Binding agents are thereby dissolved in an organic solvent or are dispersed with a limited amount of a dispersing agent in water to form an emulsion or a suspension.
Suitable binding agents are based on acrylate, alkyd/melamine, epoxy or fenol/epoxy resins. Other binding agents giving a good adhesion to the metal and to the PVC compounds can also be used.
Additives such as anticorrosion pigments, wetting agents and/or stabilising agents can be added.
The primer composition is applied to the metal by immersing the wire into the solution, the emulsion or the suspension of the primer material; the primer composition can also be applied by spraying.
The thickness of the wet primer layer can be calibrated by passing the wire and the primer through the calibrated opening of a die.
Alternatively, the thickness of the primer layer can be calibrated by felt wiping or by air wiping in a controled air stream.
The thickness of the primer layer may be influenced by further diluting the primer composition.
In order to allow drying and curing, the wire can be heated.
Since it is desirable that the weight of the canvass is as low as possible, the thickness of the primer layer must be low. The thickness of the dry primer layer is preferably less than 10 µm, more preferably less than 5 µm, for instance les than 1 µm.
Radiation curable resins such as ultra violet, electron beam or infra red curable resins are also suitable as primer.

A second group of primer layers that can be applied are hot melts, for example ethylene copolymers such as EVA (ethyl vinyl acetate), polyamides or polyesters. In order to obtain a sufficient thin layer, it is preferred to use hot melts with a viscosity at 200°C of less than 20 Pa.s, more preferably this viscosity is less than 15 Pa.s. This hot melt can be applied with a variety of different equipments. Very suitable is the melt pot. Also application by extrusion is possible under certain conditions. A method for the application by extrusion is described in the patent specification BE 1006346.

Depending on the viscosity and the method of the application of the primer layer, primer layers with a thickness of less than 25 µm, for instance less than 5 µm are obtained.

A third group are silane-compounds. One functional group of these coupling agents is responsible for the binding with the metal or metal oxides; the other functional group reacts with the polymer.

More details about these silane compound can be found in the PCT application with the application number PCT/BE98/0015. Usually the silane compounds are diluted in alcohols, although they can be diluted in other solvents or in water as well. With this type of compounds very thin primer layers with a thickness of 20 nm or even less can be achieved.

The adhesion between the thermoplastic material and the metal member can be evaluated by carrying out the following test.
The PVC layer is removed in the longitudinal direction over about 5 cm by means of the sharp side of a knife. By means of the blunt side of the knife the PVC layer is slightly lifted. Finally, the synthetic coating is tried to be pulled off the metal member with the fingers.
The more difficult the PVC layer can be pulled off, the stronger the adhesion of the PVC to the metal member.

The test is carried out both on a wire on which a PVC layer is extruded directly and on a wire coated with a primer layer before the extrusion of the PVC layer.
The PVC coating, extruded directly on the metal member can be pulled off easily, while the removal of the PVC coating is much more difficult when a primer layer is applied on the metal member.

After the application of the primer layer on the metal member the thermoplastic material is applied on the metal member.

The thermoplastic material must give a good adhesion to the canvass. Since canvasses are usually coated with PVC, the thermoplastic material is preferably a PVC compound, although other thermoplastic materials with a good adhesion to PVC can be used as well.
Canvasses can also be made of polypropylene, polyethylene or of polyester. In these cases one chooses a thermoplastic material which gives a good adhesion to this polymers.

Brief description of the drawings.

The invention will now be described into more detail with reference to the accompanying drawings wherein

- FIGURE 1 shows a fabric according to the first aspect of the present invention.
- FIGURE 2, FIGURE 3 and FIGURE 4 show three strips according to the second aspect of the present invention.

Description of the preferred embodiments of the invention.

Figure 1 shows an embodiment of a fabric according to the first aspect of the invention.
This fabric 10 comprises strips forming the warp 12 and strips forming the weft 14. The strips 12 and the strips 14 are welded to each other. The width W of the meshes is 7.5 cm, the height H of the meshes is 15 cm.

Figure 2 shows a strip 16 according to the second aspect of the invention.b

The strip comprises a hard rolled flat steel wire 18 of the type 4.00 x 0.30 mm, with a tensile strength, R_m of 1700 N/mm^2. The carbon content of the steel is equal to 0.70 %.

On this wire a primer 20 is applied. An alkyd/melamine resin is dissolved in a solvent such as benzene, xylene or in an alcohol. An anticorrosion pigment is added. The composition is about 30 % of the binding agent and about 70 % of the solvent. The primer is once diluted with acetone. After drying and curing a primer layer with a thickness between 0.8 and 2.5 µm is obtained.

The strip comprises PVC as matrix material 22. This PVC material is applied by extrusion.

The width of the strip equals to 6.00 mm, the thickness is 0.80 mm.

Figure 3 shows another strip 16, comprising a rounded I-profile wire 18'. The wire has a tensile strength, R_m of 1750 N/mm^2 and a carbon content of 0.80 %. The wire has a width of 4.00 mm. The center thickness is 0.30 mm and the thickness at the left and the right end equals 0.45 mm. This wire has the flexibility of a flat wire with a thickness of 0.30 mm and the resistance against the action of a pair of scissors of a flat wire with a thickness of 0.45 mm.

A primer 20 is applied on this wire. The following composition of the primer is used : about 30 % fenol/epoxy resin, 8 to 10 % alcohol, 2.5 % diethanolamine in water. The thickness of the primer layer after drying and curing ranges between 1 and 4 µm.

The strip comprises PVC as matrix material 22. The PVC is applied by fluidised bed coating. The strip 16 has at least on one side a flat surface.

The width of the strip is 6.00 mm, the thickness is 0.90 mm.

Figure 4 shows another embodiment of a strip 16 comprising four round st el wires 18" with a diameter of 0.40 mm.

These wires are located parallel in the plane of the strip 16. Each wire is hereby in contact with his neighbor or neighbors.

The tensile strength R_m of the wire equals 2550 N/mm^2; the carbon content is 0.80 %.

A primer layer is applied on the wires. The strip comprises PVC as matrix material 22. The strip has at least on one side a flat surface. The width of the strip is 5.00 mm, the thickness is 0.80 mm.